Volume 25 June, 1939 *Number 6*

Lubrication

A Technical Publication Devoted to the Selection and Use of Lubricants

THIS ISSUE

Logging and Sawmill Machinery

PUBLISHED BY
THE TEXAS COMPANY
TEXACO PETROLEUM PRODUCTS

TEXACO LUBRICANTS FOR LOG HANDLING AND SAWMILL OPERATIONS

LOG HANDLING

Skidders
Loaders
Shay Engines
Locomotives
Tilting Racks
Tractors
Log Cars

STEAM CYLINDERS	
Saturated Steam	TEXACO Leader Cylinder Oil TEXACO Honor Cylinder Oil TEXACO Pinnacle Cylinder Oil
Superheated Steam	TEXACO Cavis or 650-T Cylinder Oil
BEARINGS	
Sleeve Type, oil-lubricated according to clearance and temperature	TEXACO Anser, Aleph, or Altair Oils, or TEXACO Pelican Oils
Grease Lubricated	TEXACO Cup Grease No. 3 or No. 5, or TEXACO Star H Grease No. 1
SLIDES	TEXACO Aleph, Altair or TEXACO Pelican Oils or TEXACO Castor Machine Oils
SPUR GEARS	TEXACO Crater Compound No. 1
TRANSFER CHAINS & RAILS	
Normal Service	TEXACO Crater Compound
Under Water	TEXACO Crater Compound-X or XX
WIRE ROPE	TEXACO Crater Compound No. 0 or No. 1
LOG CAR JOURNALS AND LOCOMOTIVE PARTS	TEXACO Bearing Oils
ROD CUPS	TEXACO Rod Cup Grease
TRACTORS	
Engines (according to manufacturer's recommendation)	Insulated TEXACO Motor Oils
Chassis Parts	TEXACO Marfak or TEXACO Chassis Lubricants

IN THE MILL

Log Carriages
Band Saws
Resaws
Set Works
Edgers
Gang Saws
Trimmers
Slashers
Lathes
Surfacers
Moulders
Planers

BEARINGS	
Sleeve Type, oil-lubricated according to clearance and temperature	TEXACO Aleph or Altair Oils; TEXACO Pelican Oils; or TEXACO Bearing Oils
Loose running bearings	
Grease Lubricated	TEXACO 629 Oil TEXACO Marfak No. 1 or No. 2
Ball or Roller Bearings	
Oil Lubricated	TEXACO Spindle Oil A or TEXACO Cetus Oil
Grease Lubricated	TEXACO Starfak Greases or TEXACO Marfak No. 1 or No. 2
SET WORKS	TEXACO Alcaid Oil C

(Continued on inside back cover)

LUBRICATION

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Logging and Sawmill Machinery

LUMBERING has to do with felling trees, transporting the logs to the mill, sawing these logs into rough lumber and finishing the latter into commercial material. Lumbering has become unusually coordinated with the development of modern methods of materials handling. Along with this organization of the industry, has come the use of more economical methods of power generation, elimination of unnecessary steps in handling the materials and marked reduction in waste.

All this has led to reduced marketing costs. Furthermore, the volume consumer is assisted in that he can very often purchase his entire requirements of finished stock from an organization which has actually produced the original timber. In other words, many of the large scale lumber producers own their timber stands, operate railroads from logging camps to the sawmills, employ a variety of dry kilns and planing mills, and complete their cycle with sales and shipping organizations.

All this coordination requires synchronized operation, for any disruption in the functioning of machinery in any department may seriously retard production. So this machinery is being more and more carefully maintained. This is further justified by the fact that modern machinery is more costly, equipped with more carefully designed bearings, gears and chains, and generally capable of developing remarkable efficiency with low power consumption.

To attain this objective, however, these moving parts must be continually protected by lubrication. So this latter is intelligently planned and properly maintained; if, in turn, the lubricants are selected according to their lubricating ability rather than price, there is better assurance of continued production, for machines rarely fail when properly lubricated.

Present day costs of lubrication are of interest. The lumber industry talks of this in terms of cents per thousand feet from stump to car. A fair average figure is from nine to ten cents.

One of the most important factors to consider relative to lubrication is the speed and accuracy of the work. Logs are sawed at almost unbelievable velocities, with remarkable accuracy as to dimensions. These requirements had much to do with improvement in the design of sawmill machinery.

Then the conveyor builder had to assume a role, for his mechanisms had to feed logs not only to the saws, but to remove the timbers, boards or finished trim as fast as they were sawn.

FROM FOREST TO MILL

The development of a lumber tract requires a knowledge of forestry, tree growth, surveying, mapping, railroading, materials handling and, later, the paper making and building industries.

These latter industries take the majority of the wood logged today. Certain woods best meet the requirements of each. For paper making, pulp is the objective; it is produced from pine or other evergreen woods, such as spruce, hemlock and cypress. The building industry is concerned with grain, knots, splintering, etc. In other words, how the surface can be finished. Here we find southern pine and Douglas fir for rough timbers, and maple,

hickory, chestnut, cedar and oak for trim work.

Felling the tree is obviously the first step in producing lumber or logwood. It may be still a manual operation in some localities, requiring a two-man cross-cut saw, or power saws can be used. The first machines we find in the woods are the skidders, tractors and rope hauls which snake or drag the logs from where they have been felled to the point of transportation to the sawmill. Where flowing water is available, they are rafted down to the mill. Otherwise, the logs are loaded onto log cars for rail transportation.

Courtesy of West Coast Lumbermen's Association

Fig. 1—Showing how the donkey steam engine can be used in logging operations.

Log Handling

This procedure, as carried out by the skidder, involves a portable machine built on a railway flat car, with a long purchase boom from which wire cables are run to the revolving drum of an ordinary geared steam hoisting engine. The crawler tractor covers a wider area, but performs a similar duty. Other arrangements are, of course, practicable, using trees as "spars" for cable supports and a bicycle carrier to speed up the operation. Regardless of the log handling arrangements, the lubrication engineer is concerned with wire rope, steam cylinders, internal combustion engines, exposed gears and the usual bearing assemblies required on hoisting machines.

Hoisting mechanisms are also necessary in the operation of the logging wagons which are often used in conjunction with the skidders. These wagons are equipped with steel tongs which are capable of lifting the logs onto the wagons or dragging them to the skidders.

Transportation of logs to the mill depends upon the facilities available. Where these include water, the logs are hauled or dragged to the river and floated to the mill. Where rail transportation is necessary, trains of log cars must be used. In the North woods in winter, sledding over the snow and ice is practicable.

Water transportation and log pond storage are of advantage in that dirt and stones are washed off and the logs go to the saws in wet condition. This assists in good sawing.

When the mill is ready to receive the logs, they are floated one by one to a chain conveyor which extends from the log deck in the mill to beneath the surface of the pond. At this point, there is a spool or sheave around which the chain revolves. This chain is equipped with spikes or dogs which grip each log and carry it up to the log deck in the mill.

The driving mechanism or log jack required to operate this chain is one of the heaviest duty machines in the mill. It consists of a powerful reduction gear carrying the log deck sprocket wheel for the conveyor. This entire assembly is in almost continuous operation, but, fortunately, it travels slowly, so periodic examination and lubrication of the various parts can be made without much trouble.

At the top end of the conveyor, a steam kicker pushes the logs sidewise from the chain and onto the log deck. This latter slopes downward to the log carriage of the head-saw. At this point, a steam, air or electric loader carries them onto the log carriage.

Steam Power

Steam power still predominates in logging, although electric yarding engines are coming into quite extensive usage. By the use of steam, the powerful donkey engine can be adapted to "yarding," "skidding" and "loading." The fuel is cheap—oil or wood refuse—and the boiler and engine assemblies can be readily designed for portability. In other respects, the service is severe, for the engine, like its hoisting mechanism, is often exposed to the weather, or at best, it is but imperfectly housed. Steam power is also required for the log train locomotives and for the "yarding" Shay engine.

Careful lubrication of steam cylinders will assist in reducing maintenance costs and improving power output. Any loss of steam through blowby past the pistons or rod packing means loss of power at the hoisting drum.

Steam conditions are usually the controlling factor in the selection of cylinder oils for any steam operated mechanism. As a general rule, we will be dealing with wet or saturated steam of average pressure—generally not exceeding 175 pounds. The temperatures corresponding to pressures within this figure, coupled with the moisture content of the steam, require the use of a compounded cylinder oil ranging in viscosity from 125 to 175 seconds Saybolt Universal at 210 degrees Fahr. (comparable in body with an S.A.E. 140 gear oil).

Compounding means adding a certain percentage of animal fat—usually lard oil, tallow or degras—to the mineral cylinder stock to develop emulsifying or lathering qualities when mixed with water. This lather has excellent adhesive ability, so it covers the cylinder walls and valve seat surfaces with a tenacious film which effectively resists being subsequently washed off by the continual rush of fresh wet steam or the exhaust.

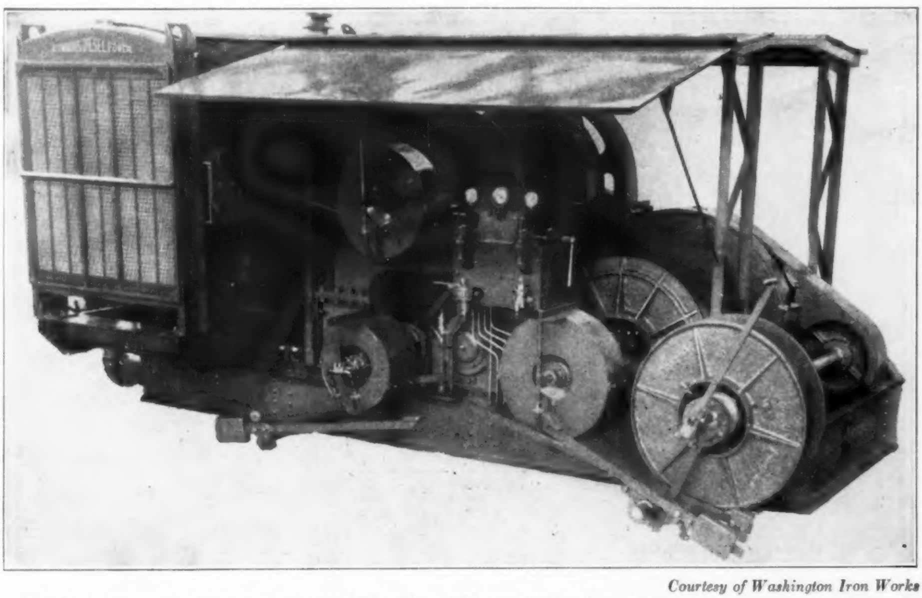
But a few drops of such an oil delivered per minute by a mechanical force feed or hydrostatic lubricator will keep the average locomotive or donkey engine cylinders well lubricated.

Actual lubrication of a steam cylinder is brought about by the steam. It is, therefore, essential that the oil be delivered to this latter in a manner conducive to thorough atomization, and that complete, uniform and constant dispersion of the particles of oil be made throughout the body of the steam before it enters the valve chest and cylinder. This can be accomplished by using a properly designed atomizer, located a few feet above or in back of the throttle valve, in conjunction with a positive feed mechanical or hydrostatic lubricator.

Provided conditions of application are mechanically correct, the steam should be thoroughly impregnated with sufficient oil at a rate of but a few drops per minute, insuring not only economy of oil, but also adequate protection of valves, valve seats, cylinder walls and piston rings.

Effect of Pressure

The effect of steam pressure upon atomization requires consideration of the viscosity or body of the oil. In general, the higher the pressure, the more rapidly can atomization be accomplished. This is an important point to remember where the lubricator inlet or atomizer may be located within approximately three feet of the throttle valve. Inasmuch as it is desirable for the oil to be completely atomized by the time it reaches the latter, the relation of pressure to viscosity must also be understood. The higher the pressure, the greater the temperature; in other words, the greater the viscosity-reducing effect. An oil,

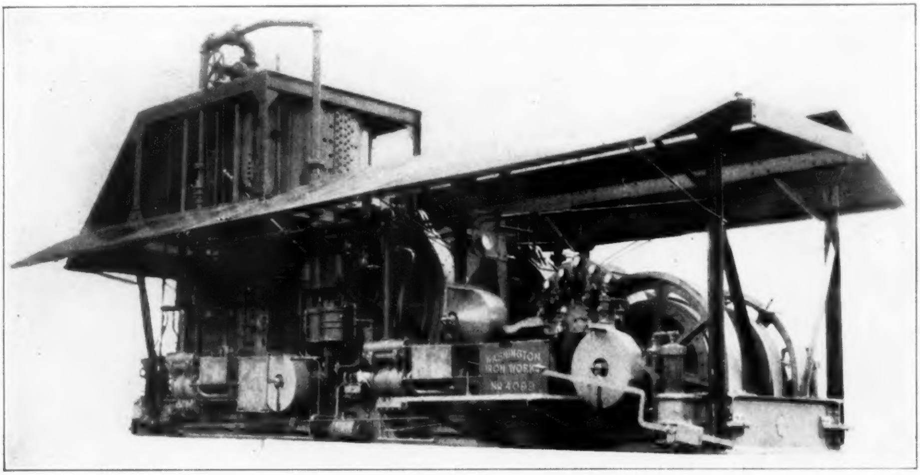


Courtesy of Washington Iron Works

Fig. 2—A four-speed Cummins Diesel "yarding" engine. This machine has been designed for protected lubrication as the housing indicates.

of, say, 135 seconds Saybolt viscosity at 210 degrees Fahr., will, therefore, become thinner and more readily atomized by steam at 150 pounds pressure than by steam at 125 pounds.

In consequence, pressures of 150 pounds or above will require the use of oils of higher viscosity, particularly where application is not too close to the throttle. With lower pressures, on the other hand, a similar installation would probably function best on a lighter oil. In any type of service requiring consideration of atomization speed, however, it is essential to remember that ability to atomize will vary directly as the amount of compound used. Lower viscosity oils containing from six to ten per cent of compound such as degras or tallow can, therefore, be expected to be best suited to moderate pressure wet steam conditions.



Courtesy of Washington Iron Works

Fig. 3—A Washington Iron Works duplex flyer. Lubrication of this machine is much the same as for the skidder. Note means provided for protected lubrication. Four sets of engines are used in the cable handling operations.

Means of Application

It is important to remember that an atomizer should be so located in the steam line as to be subject to straight line flow of steam without the possibility of surging; otherwise, there might be a tendency for the oil to be thrown to the sides of the steam pipe. This would be particularly likely to occur should there be any bends between the atomizer and the valve chest. Obviously, oil thrown to the sides of the pipe would cease to be atomized; therefore, it could not function to best advantage in subsequent lubrication of the valve chest and cylinder surfaces. Normally, it might be expected to be wasted, causing possible trouble by accumulation and carbonization in low parts of the cylinder.

Tractor Operation

The crawler type of tractor is being used to quite some extent in logging operations today. Where the ground will permit, it can be used to do all the yarding of logs to the loading point, also to supplement cable hauls. This, in turn, reduces "spar" tree rigging.

Tractor mechanisms, their lubrication and operation have been repeatedly discussed, both from the gasoline, as well as the Diesel engine angle. For the benefit of the logging industry, it will be well to repeat certain details which have a direct relation to engine performance and maintenance costs. From the engine viewpoint, this involves power and fuel economy.

Any tractor engine which is lubricated with an oil which has been selected with due regard to the operating conditions will be best capable of developing maximum power with the greatest economy of fuel.

Maximum power becomes possible only where there is maximum compression. While this is chiefly affected by carbon deposits and uneven seating of the valves, we must not overlook the movement of the piston rings in their respective grooves, and the extent to which they maintain the requisite seal between the cylinder walls and piston to prevent "blowby."

The purpose of these rings is to take care of the more or less variable clearance which practically always exists between the above parts. As a result, these rings must be capable of as free movement as possible. This can only be attained by keeping them free from carbon or gum deposits. Under such conditions, regardless of the age of the engine, or

the variation in clearances, if the rings are not abnormally worn and if the oil film is of the requisite body, compression losses will be practically negligible. On the other hand, rings which have worn unevenly or become stuck due to carbon or gum formations, will tend to reduce the power capacity of the engine. In addition, dilution will occur and general operating efficiency will fall off materially.

The effect that "blowby" will have on the engine is noteworthy. In the first place, it will in all probability reduce, or, in many cases, wash off the lubricating film from the cylinder walls. The direct result may be scoring of the latter due to lack of lubrication, especially if dilution of the oil in the crankcase has occurred to an excess. Furthermore, this will lead to the consumption of more power in overcoming friction between the wearing parts of the engine. The thinner the oil by virtue of dilution with fuel, the greater, also, will be the possibility of dangerous metal-to-metal contact in the bearing elements.

Crankcase dilution of the lubricating oil in any heavy duty engine using low-volatility fuels will be more prevalent than in the average automotive-type engine which functions on gasoline. This is because light fuel oils or kerosine vaporize less completely than gasoline; in consequence, the heavier unvaporized parts are ready and capable of exerting a solvent action upon the oil film on the cylinder walls to possibly get by the rings under favorable conditions.

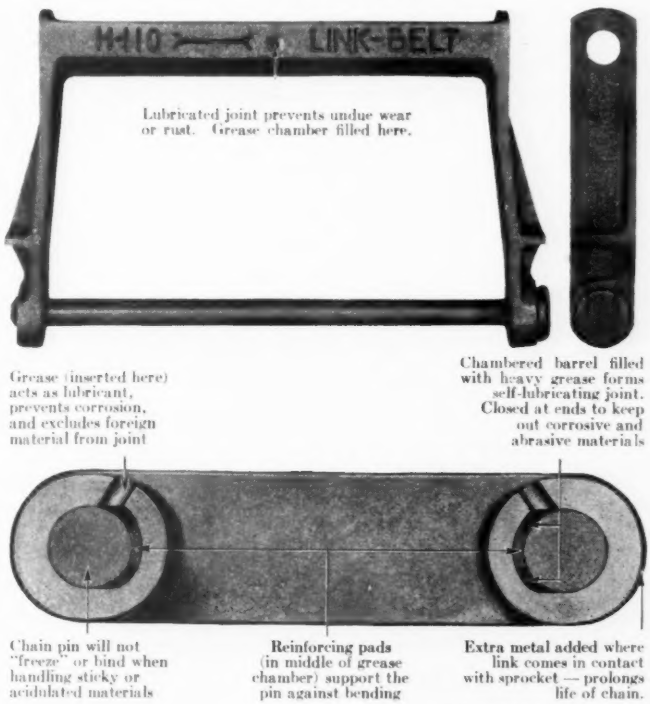
Diesel or kerosine engines will generally function at somewhat higher temperatures than a gasoline engine. This fact will naturally tend to aid in the attainment of more complete vaporization and offset the relatively low volatility of the heavier fuel. Yet it cannot do this completely; as a result, dilution is an ever-present possibility and its effects must never be overlooked.

Wire Rope

Wire rope is one of the most widely used materials in lumbering operations, for it is the primary means whereby power is transmitted. Since logging is always an out-door procedure, wire rope is continually exposed to the elements; load conditions are severe, and inspection is often difficult. All the while the rope must be dependable, for failure might seriously retard the flow of logs to the sawmill, not to speak of the hazard to the woods crew.

Dependable operation of wire rope can best be assured by protecting the strands against wear, rust and corrosion. It is a direct function of lubrication. So lubrication of wire rope is one of the most important items in the lumberman's maintenance program. It begins with the selection of the lubricant, then storage, and finally, intelligent application.

The service to which the rope is put will, of course, control its maintenance. The rigging for a "spar" tree is stationary and serves to guy the tree against excessive swing when loads are applied by the "skidder," "yarding," or "loading" rig. The wire rope on the latter is movable, working over drums, much like the rope on a crane or hoisting engine. It is this movable rope which must be most carefully lubricated, for it is continually flexing as it runs round the drums. This develops friction between the strands; it also opens these latter to entry of moisture into the interior of the rope. Rust or corrosion at this



Courtesy of Link-Belt Company

Fig. 4—Two Types of Link-Belt chains adaptable to log handling. Above is the "H" class conveyor chain; below is cut-away of the barrel of the Link-Belt chambered barrel type combination chain. In each case note method of lubrication.

point is most serious, for it is difficult to detect. All the while the strands may be rapidly weakening.

In other words, wear will occur in any wire rope in service. It is impossible to absolutely

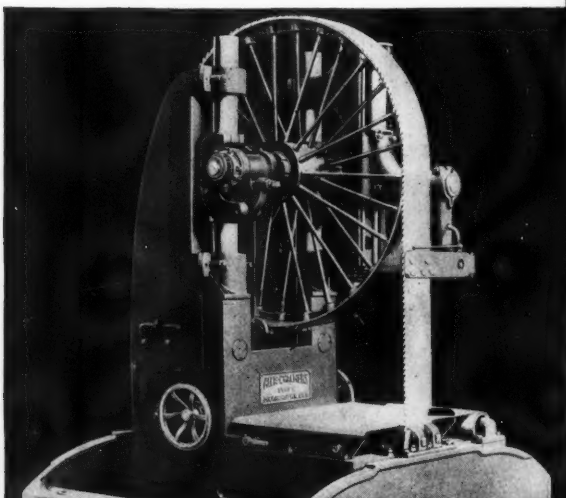
Courtesy of West Coast Lumbermen's Association

Fig. 5—(Above) Log Handling in the Douglas Fir region of the Pacific Northwest. Note the adaptability of the crawler-type tractor for yarding of logs to the loading point, also to supplement cable hauling.

Fig. 6—(Below) A Jeffrey log haul with renew
flat and round steel link chain.

Courtesy of Link-Belt Company

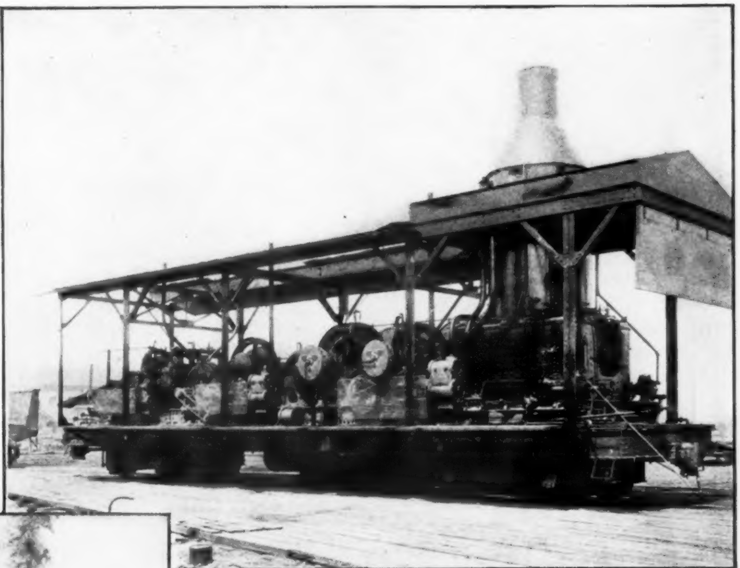
Fig. 8—(Right) A Link-Belt sawmill conveying chain installation, showing adaptability to handling wood refuse.



Courtesy of Allis-Chalmers Manufacturing Company

Fig. 10—(Left) An Allis-Chalmers Type "C" bandmill with roller arbor bearings and steam lift upper guide. This mill can be used for either single or double cutting.

urtesy of The Jeffrey Manufacturing Company
spurs and large diameter rollers mounted on

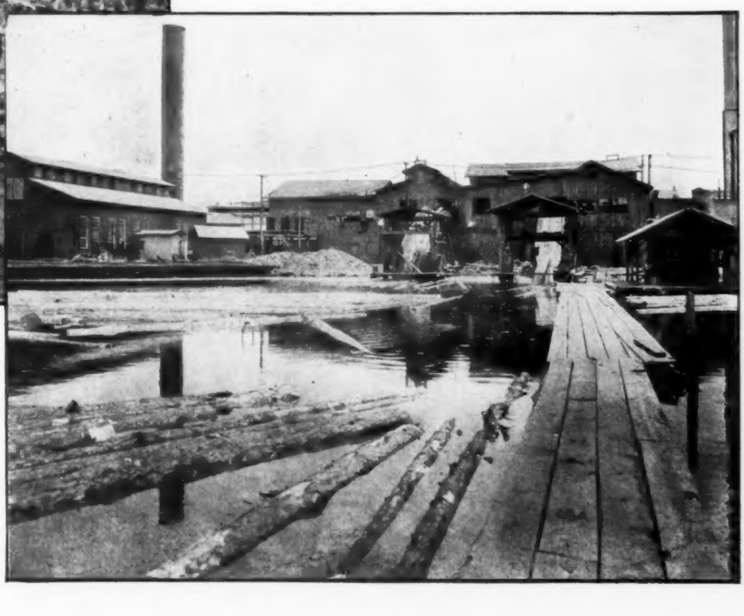


Courtesy of West Coast Lumbermen's Association

Fig. 7—(Above) A steam operated tree rig skidder as used in the Douglas Fir region. This machine furnishes the motive power to "skid" logs from the stump to the car.

Courtesy of Allis-Chalmers Manufacturing Company

Fig. 9—(Left) Another view of a crawler tractor in log skidding work. The nature of the terrain is of interest, also the number of logs which can be handled at the same time.



Courtesy of The Jeffrey Manufacturing Company

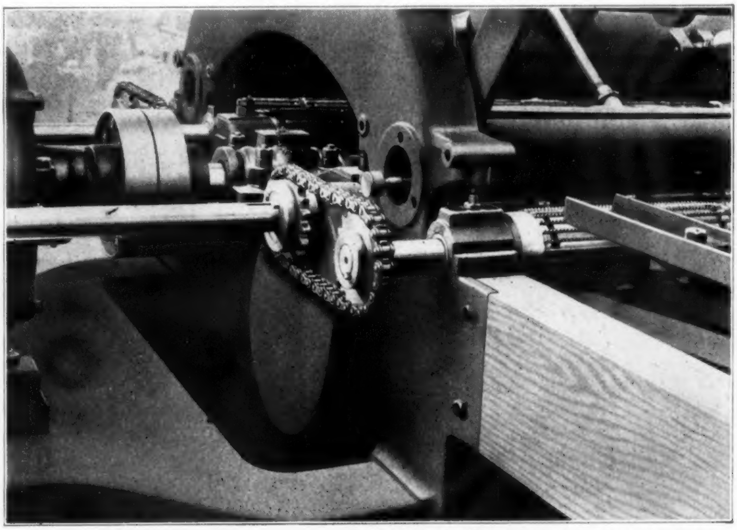
Fig. 11—(Right) A typical log pond with Jeffrey chain haul-ups to handle logs from pond to mill. The lower ends of these hauls are well under water to facilitate log pick-up by the spurs.

eliminate friction between individual strands, the rope surface and the sheaves or winding drums, however suitable the lubricant or the attention paid to lubrication.

On the other hand, deterioration through age or the effects of outside causes such as water or excessive heat can be effectively counteracted by judicious application of the right kind of rope lubricant.

This can be effectively brought about by saturation of the core of a wire rope, and if the latter is not neglected after being put into service, it can be maintained at its maximum flexibility, with the core serving as an adequate reservoir for the rope lubricant.

No wire rope lubricant should be used which may have a damaging effect upon the core fibres of the rope, for it will result in more or less reduced protection. Products of a tarry nature which may contain a certain amount of acid would be detrimental and would fall in this category, yet in general appearance they might be very deceiving and similar to the more suitable straight mineral rope lubricant.



Courtesy of Allis-Chalmers Manufacturing Company

Fig. 12—An Allis-Chalmers edger with revolving guide carrier shafts. Suitable closures protect the lubrication of much of the mechanism.

Other factors to guard against are fillers such as flake graphite, asbestos, etc., for they will frequently be detrimental, especially if the rope is to be used under relatively low temperature conditions. Fillers will often tend to cause flaking or cracking of lubricating films in service of this nature, water or other destructive or corrosive elements subsequently gaining entry through the seams.

It will be of interest in this connection to note the possibilities of greases or soap-thickened mineral oils as lubricants. Such products, in general, while frequently of a consistency approximating that of a straight mineral wire rope lubricant, will often not have the requisite adhesive ability. To give a grease the necessary degree of consistency, a relatively large amount of soap would have to be used. The essential function of soap in a grease is to hold or to retain the required amount of lubricating oil. It normally does not give much lubrication. In consequence, the average grease would frequently not only fail to penetrate within the rope as desired, but also it might not be able to resist the effects of temperature or centrifugal force. Furthermore, the lubricating ability per pound would be lower.

The most effective lubricants for wire rope are straight mineral products in which consistency is an actual property, not built up as in certain greases or compounds. Such a lubricant of a viscosity ranging from 500 to approximately 1000 seconds Saybolt at 210 degrees Fahr., will, by virtue of this comparatively high consistency, have a natural adhesive tendency which compounding or resorting to so-called artificial means can seldom equal.

A wire rope lubricant must never be too heavy or viscous, for a product which is too heavy would lack in penetrative ability, and while the exterior of a rope might seem to be effectively lubricated, the inner strands and core might be suffering, and in a condition conducive to rapid deterioration.

There are too many operators who will have a tendency to treat their ropes with highly viscous gear lubricants which, while adequately adhesive, frequently cannot penetrate throughout the strands or saturate the core to the requisite degree. Under abnormally high temperatures, they may give approximately the desired results, but such conditions are rarely entirely constant. Too, under lower temperatures, power consumption might be materially decreased due to internal or molecular friction within the lubricant.

Wire ropes can be relubricated in a number of ways. Troughs or split boxes through which the ropes can be passed during operation are very effective. Such containers can be filled

to the necessary level with heated lubricant. Another method is to set up a barrel or drum above the rope so that the lubricant can drip from a suitable outlet valve, the container being equipped with steam coils for maintaining the temperature therein constant and as high as desired.

Where such equipment is used, a brush for spreading, arranged so as to be relatively fixed in position and in contact with the rope, will be advantageous. By locating the bristles beneath the flow of fresh lubricant, they can be maintained in saturated condition so that the maximum of spreading will be accomplished with the greatest economy.

Flexing or working the rope around drums or sheaves while the lubricant is hot and fluid enough to find its way between the strands and down to the core will frequently promote penetration to a marked degree.

Gears and Chains

Gearing, like wire rope in the logging camp, is exposed to weather conditions which at any time may impose an unusual and severe load upon the lubricant. Furthermore, temperature variations may be very wide, also loads and the possibility of considerable lubricant contamination. So we must be well informed regarding the adhesive and water-resisting characteristics of the various gear lubricants available; likewise their ability to withstand heat and cold without flowing to excess or cracking.

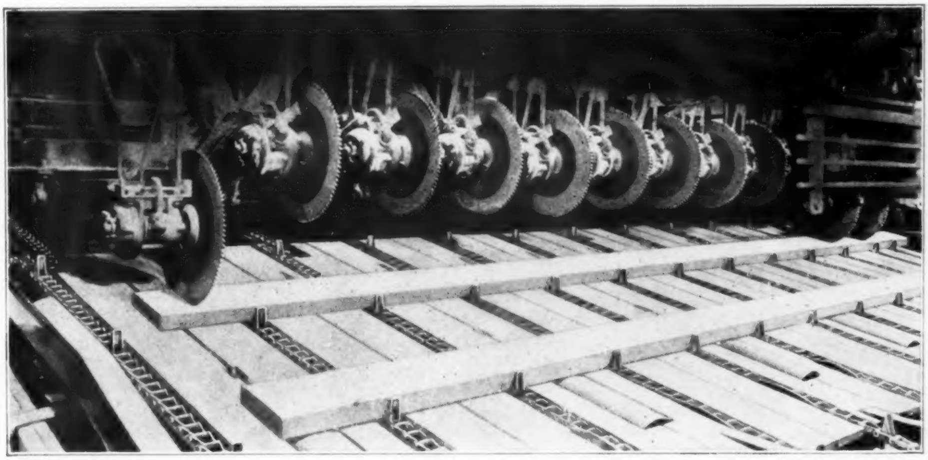
The petroleum industry, being fully aware of the requirements, has studied the refinement of gear lubricants for years. By judicious selection of crude oil stocks, methods of blending, and the use of water-resisting materials, some most dependable products have been developed.

A gear lubricant must always possess adequate lubricating ability to reduce friction to a minimum. This characteristic is dependent upon the viscosity, the adhesiveness and the ability to resist prevailing tooth pressures.

Temperature will affect both viscosity and adhesiveness in the normal operation of logging machinery; gears will function at atmospheric temperature, but, as stated, the range may be wide, although there will be but little possibility of the lubricant's being reduced in viscosity by abnormal heat.

Low temperatures require more serious consideration. Certain grades of lubricants will have a tendency to congeal to such an extent as to become brittle and crack. Specially refined gear lubricants resist this reaction. It has been further developed that, unless water conditions are constant and extreme, straight mineral lubricants will generally be best adapted to average operating conditions. The normal viscosity range for service on exposed gears will vary from approximately 500 to 1000 seconds Saybolt at 210 degrees Fahr., the higher figure being more nearly right to meet the usual requirements.

Enclosed gears, or gears in assembly with chain drives, as are found in certain power transmission units, will usually require a more fluid lubricant. The average enclosed chain drive will involve comparatively low clearances between the connecting elements which go to make up the links. The lubricant must be capable of penetrating to all surfaces of contact between these parts; otherwise, abnormal wear will take place. Here an oil of about the same viscosity as a heavy steam cylinder oil,



Courtesy of Link-Belt Company

Fig. 13—A Link-Belt malleable iron chain with conveying attachment operating in conjunction with a sawmill trimmer. Note the gang saw arrangement.

i. e., in the neighborhood of 150 to 200 seconds Saybolt at 210 degrees Fahr., should be used.

Noise may indicate wear in any gear or driving chain assembly. It cannot be associated with heat for, as a general rule, there will be better ventilation than prevails with the average bearing. So any increase in operating temperatures will not be so obvious, even in extreme cases of faulty lubrication of gear teeth or chain link connections, for radiation will serve as an effective means of temperature reduction.

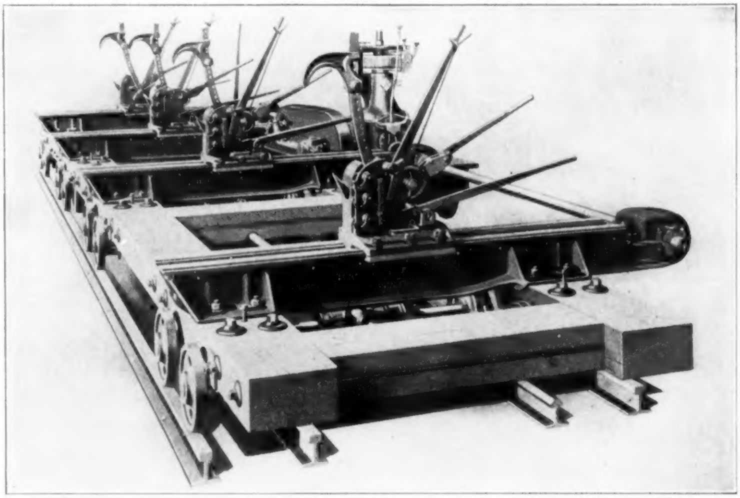
In gear operation there will be periods during which the lubricant will be inactive, for actual friction between the teeth will only occur when they are in mesh. To a somewhat less extent the load imposed upon a chain link connection will also be decreased over the period of slack operation.

Chain lubrication can be likened to bearing lubrication with regard to the requirements which will be imposed upon the lubricants. There is, however, more chance for lubricant to be thrown off from a chain link than from the average bearing, for, even though bearings may be themselves subject to rotary or reciprocating motion, this will not be so severe as the action of centrifugal force on a chain. This force must be especially considered in the lubrication of exposed or semi-enclosed chains. Centrifugal force will be greatest during the period of bending, as the chains pass over the sprockets. At such times, any lubricant on the outside surface of a chain may be thrown off, although this will depend upon the adhesive ability of the lubricant and the peripheral or surface speed of the sprockets.

IN THE SAWMILL

Sawmill operations begin with the head saw. This is mounted in a headrig. It is practicable to use either a circular or band saw in this rig. The latter is most commonly used for the first cutting which saws the logs into timbers, "cants" boards or slabs. Band saws are from eight to eighteen inches wide and run at very high speed—usually around ten thousand feet per minute.

Obviously the band saw is expensive, so it must be carefully protected. The mill operator often takes the precaution of using small adjustable circular saws for making the initial cut. These take any damage to the blade which might result from rocks or sand imbedded in the bark. Lubrication, in turn, protects the machine parts and reduces maintenance costs.



Courtesy of Allis-Chalmers Manufacturing Company

Fig. 14—The Allis-Chalmers four block Pacific Coast log carriage. The mitre gears driving the screws are enclosed in oil-tight cases to protect lubrication. Note the setworks and means for operation.

The log carriage runs the log (end-on) up to the head saw, and holds it in position for cutting. In other words, the carriage controls the motion of the log and its contact with the saw, for the latter moves in a fixed position with respect to the carriage. The band saw is virtually a steel belt traveling around two wheels. It functions vertically and cuts on the downward side.

Handling of a log at the headrig must be expertly controlled and every operation under manual control must be executed without delay. Here the head sawyer determines the maximum of marketable lumber which can be cut from a log and the best relative position for the first cut.

Both band or circular saws are used for resawing or cutting the timber or "cant" into board or plank thicknesses. Resaws may be single or of the gang type. Circular saws of the plain or inserted tooth type are used in the "edger" which rips the bark or rough edges from cants and also rips them to narrow widths. Gang saws are built with their saw blades set parallel to each other.

Load Conditions

In deciding upon the types of lubricants which will assure of most satisfactory operation of sawmill machinery, we must consider primarily the loads developed by the strains imposed in sawing. Of almost equal import-

ance are the speed conditions and the necessity for studying bearing design to prevent lubricant contamination.

It is important to realize that both the band-saw and resaw must operate under a heavy strain, for saw tension must be strong and uniform to prevent "snaking" or cutting of a non-uniform line. This strain is extended to the band-wheel arbor and bearings.

Band Saw Lubrication

Lubrication of these latter will vary, according to this strain and the design of the bearings. In sleeve-type bearings which are subjected to some 300 to 500 r.p.m. at 10,000 feet rim speed and a saw strain of from 12,000 to 20,000 pounds, oil must be directed to the bottom half of the upper wheel bearing and to the top half of the lower wheel bearing. Collar oilers are widely used for this purpose. These bearings carry all the load. Frequently they are water-cooled to maintain uniform temperatures. Here a heavy straight mineral industrial machine oil is usually required.

On other types of band mill saws which have their arbor bearings equipped with anti-friction bearings, grease lubrication is preferable. A medium-bodied product refined to meet the stability requirement so important in ball and roller bearing service should be used under such conditions. Greases of this nature possess a factor of safety in respect to their ability to function over a wide temperature range.

The Log Carriage

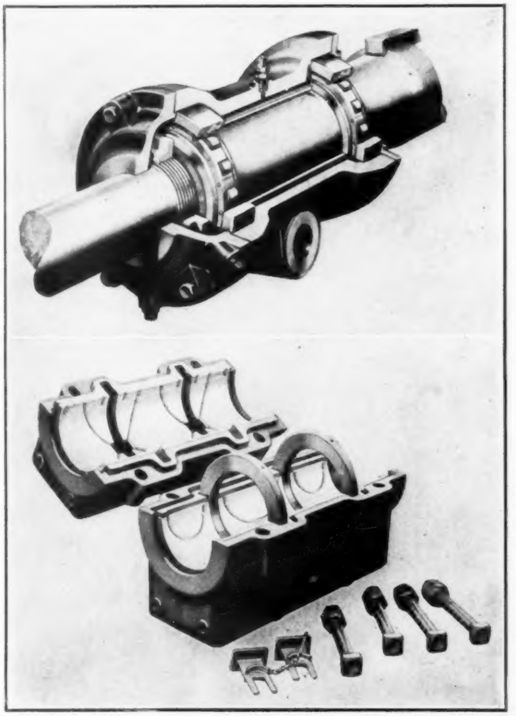
This machine may be operated electrically or by steam. Improvements in electric motor bearing design have simplified materially the problem of lubrication on all electric-powered mill machinery. Where steam is used, we will have to contend with the difficulties attendant to cylinder condensation, wet steam and frequently considerable pressure drop. The steam driven carriage is operated by plunger mechanisms usually known as "shot-guns." They are hand operated, so the valve motion must be sensitive, for they are worked continually by the sawyer. If they become dry, reduction in the cut will result.

Some mill men are convinced that these valves present the most difficult lubricating problem in the sawmill. The secret is to provide an oil which will keep them as sensitive as possible; they rarely show any wear, but they must function at the slightest touch.

To meet the prevailing steam conditions, a highly refined, compounded steam cylinder oil is necessary. Normally a viscosity range of 125 to 150 seconds Saybolt at 210 degrees Fahr., and a compound content of from five to eight per cent will be satisfactory. This same oil can also be used on other steam operated mechanisms, such as the "steam nigger" which turns the logs on the carriage; the oil will develop the necessary lathery film of lubricant, and it can be readily handled by central pressure lubricating systems.

The mitre gears which drive the set screws on the screw block carriages are enclosed in oil-tight cases; this permits of oil lubrication by means of a selected gear lubricant comparable to a S.A.E. 80 gear oil. These screws hold the head blocks and develop considerable load upon the gears.

On rack and pinion carriages, the tooth elements are exposed, so they require a heavier gear lubricant and one sufficiently adhesive to resist dripping. Normally, a viscosity range of around 1000 seconds S.U.V. at 210 degrees Fahr., will suffice. Suitable springs are provided to cushion the shock when logs are loaded or turned; this materially relieves the load on the rack and pinion teeth.



Courtesy of Allis-Chalmers Manufacturing Company

Fig. 15—Arbor bearing details for the Allis-Chalmers Type "C" band-mill. Note the (cut-away) roller bearing mounting above, and below, details of the collar-oiled, water cooled babbitted bearing. The oil-grooving is of particular interest.

Edgers and Gang Saws

The extent to which these units may be used will depend upon the type of lumber to be produced after the log has passed the headrig. The edger rips, as has already been mentioned,

The gang saws cut the "cant" or timber into more marketable sizes, or strips of from one to two inches thick.

The gang saw consists of a row of saw blades set parallel in a suitable frame. It is driven by a crank through a connecting rod which imparts the necessary reciprocating or up and down motion. All parts must be rigidly constructed, as it is desirable to saw several "cants" into boards simultaneously.

The gang saw crank must be very carefully lubricated. It is another mechanism which carries a heavy load, and so becomes subject to considerable heat. Pressure lubrication, therefore, is desirable, using the same oil as suggested for the bandsaw wheel bearings. Water cooling is also helpful.

Edger mandrels which are hand oiled require a lubricant which will stick tenaciously and resist being thrown off. The arbor bearings, in turn, may be either collar-oiled, water-cooled sleeve bearings, or of anti-friction type. The latter are provided for grease lubrication. In either case, lubrication is relatively automatic, and protected against contamination by sawdust. The same holds true for the modern feed and press roll bearings.

CONVEYING

The conveyor is probably the most widely used mechanism in lumbering. From the log pond to the handling of finished marketable products, it is used to move materials to and away from the saws, to the kiln buggies and to points of storage. The chain type of conveyor has proved its adaptability to this industry, just as it has assisted in perfecting the paper industry by expediting the stacking or handling of pulpwood.

"Live" rolls are also used for lumber conveying. These are rolls under constant rotation, being driven through a power transmitting connection.

Conveyor and roll bearing lubrication is a matter of protecting the various bearings against undue wear or excessive corrosion. Abrasive foreign material causes wear; water causes rust and corrosion. Lubrication materially reduces these detrimental effects by maintaining a protective film on the contact surfaces of the moving parts.

Roll bearings may be oil or grease lubricated, according to their design. Where the roll necks or journals are carried in sleeve-type bearings, oil lubrication by means of cups, or ring or collar oilers is usually required. Grease cup or pressure gun lubrication is equally as effective, especially if high clearances prevail. Wherever ball or roller bearings are used, grease is almost always required, just as on the edger roll bearings.

Chain Conveyors

The chain conveyor, as it has been designed for log handling and sawmill service, is based on the pintle link principle. Very careful consideration has been given to lubrication in the perfection of many of such chains, in the realization that wear (by entry of abrasive foreign matter) may seriously mar the contact surfaces of the links.

Grease lubrication has proved to be very protective, and modern chain design (see Figure 4) provides link joint lubrication by pressure grease gun. By cutting away the link within, a grease chamber is developed which holds a reserve supply for protection of both the pin and link surfaces.

KILN SEASONING

The final treatment in preparing lumber for the market involves kiln drying to evaporate most of the water content. This is a mechanical process of aging or seasoning. It is essential to the production of uniform grades of materials and the prevention of subsequent warping or shrinkage. So all boards and finished lumber after leaving the gang saws, edgers and trimmers, are loaded onto kiln trucks and passed through steam-heated dry kilns.

Kiln seasoning accelerates the more tedious process of air drying in the open, as it is carried out at a temperature from 100 to 200 degrees Fahr. From 48 hours up are required, according to the character and thickness of the lumber.

Lubrication of kiln truck axle bearings is important, due to the continued high temperatures involved. Grease lubrication by means of the pressure gun is being widely accepted as conducive to best protection of the axle bearings. The prevailing temperatures require the use of a high melting point grease of anti-friction characteristics. By using such a lubricant, there will be best assurance against grease breakdown, and formation of detrimental deposits. The heavy oil content in turn assures that such a grease will stay put and resist leakage when exposed to these temperatures.

Kiln fan bearings are akin to electric motor bearings, so they are lubricated in much the same manner. Frequently, they are of anti-friction type. Wherever the installation may be exposed to high temperatures, it will be advisable to use a grease comparable with that suggested for the kiln cars. Where oil lubrication is necessary a medium-to-heavy bodied straight mineral oil should be used, according to temperature conditions. Wick oilers are applicable to the lubrication of these bearings.

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IN THE MILL

(Continued from inside front cover)

Line Shafting Conveyors	**Slides, Guides or Ways**	TEXACO Castor Machine Oils, or TEXACO Aleph, Altair, or Pelican Oils
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Electric Motors Oil Lubricated	TEXACO Regal Oil B, or TEXACO Canopus, or Cetus Oils
Grease Lubricated	TEXACO Starfak Greases, or TEXACO Marfaks
Chain Drives Enclosed—*Oiled*	TEXACO Aleph, Mira, or Altair Oils
—*Grease Lubricated*	TEXACO Hytex Grease No. 3, or TEXACO Star H Grease No. 00 or No. 1
Exposed	TEXACO Crater Compound No. 0 or No. 1

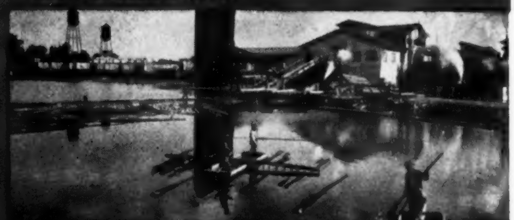
LUMBERING IN LOUISIANA

General view of Louisiana Central Lumber Co. mill property at Clarks, La. These mills cut 215,000 board feet of pine lumber a day. Entire property has been Texaco lubricated 100% for past 10 years.

Logging over the Louisiana Central Lumber's own standard gauge railroad, 50 miles in length. All locomotives are Texaco lubricated 100%.

Steam loader loading log cars. This railway equipment on this property is Texaco lubricated . . . has been for past 10 years.

Ford trucks and International tractors in Louisiana Central's forests . . . All automotive equipment has been Texaco fueled and lubricated for past 10 years.



Louisiana's log pond and dumping rack, receiving logs by motor truck and by rail. All hauling equipment is Texaco lubricated 100%.

Corner of one mill on Louisiana Central Lumber's property. All equipment here has been 100% Texaco lubricated for 10 years.

Louisiana Central's engine room, containing a 30" x 48" Corliss and several turbines. All equipment has been Texaco lubricated 100% for 10 years.

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